

RECEIVED

DEC 30 2004

IPD
GENERAL ELECTRIC

(12) UK Patent Application (19) GB (11) 2 213 792 (13) A

(43) Date of A publication 23.08.1989

(21) Application No 8828731.3

(22) Date of filing 08.12.1988

(30) Priority data

(31) 3742523 (32) 15.12.1987 (33) DE

(71) Applicant

Waeschle Maschinenfabrik GmbH

(Incorporated in the Federal Republic of Germany)

Kanalstrasse 55, D-7980 Ravensburg,
Federal Republic of Germany

(72) Inventor

Paul Lübbehusen

(74) Agent and/or Address for Service

D Young & Co

10 Staple Inn, London, WC1V 7RD, United Kingdom

(51) INT CL⁴

B65G 53/52

(52) UK CL (Edition J)

B8A A3AT

F2P PC3

(56) Documents cited

GB 2142414 A

GB 2056285 A

GB 2043867 A

GB 1493804 A

GB 1319800 A

GB 1293108 A

GB 1164370 A

GB 1110287 A

(58) Field of search

UK CL (Edition J) B8A A3AF A3AS A3AT, F2P PA9

PC3 PC9, G3H HAA HF

INT CL⁴ B65G, F15C, F15D

(54) Conveyor pipe for pneumatically transporting bulk material

(57) The conveyor pipe (1) includes a pipe wall with an interior wall surface provided with projections directed radially inwardly toward the interior of the pipe for eliminating the formation of angel hair. The projections (2) have a radial height less than about 1 mm, preferably at least 10 μ , and may be formed by the wall or annular or helical ridges 2, Fig 3, or by a metallic or plastic insert, eg grid, grating or spiral 6, Fig 4.

Fig. 3

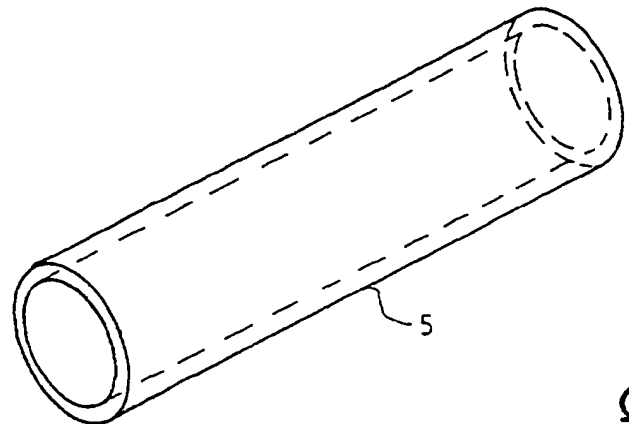
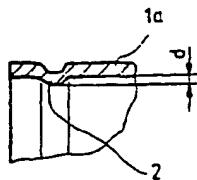


Fig. 4

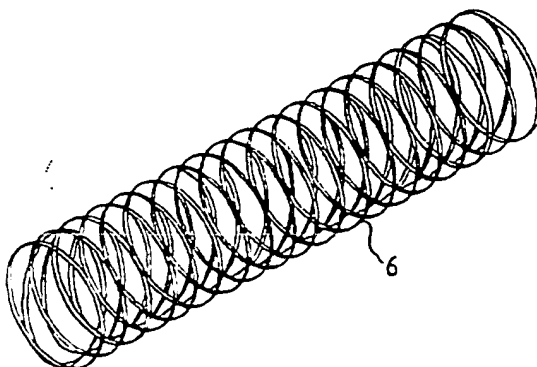


Fig. 1

2213792

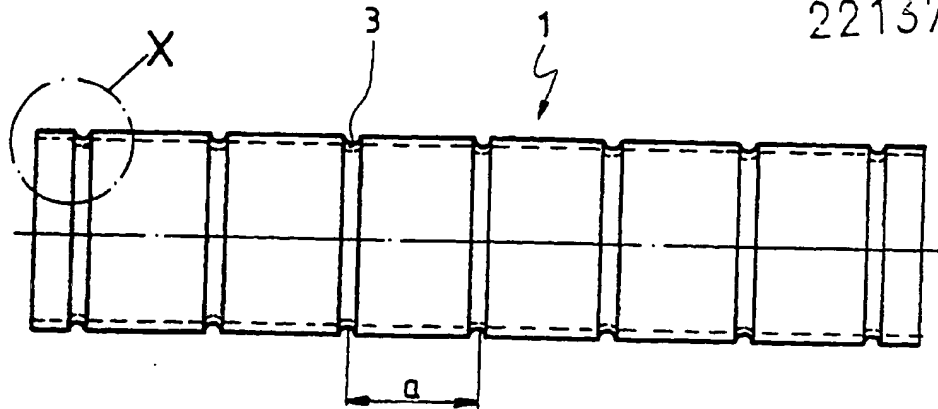


Fig. 2

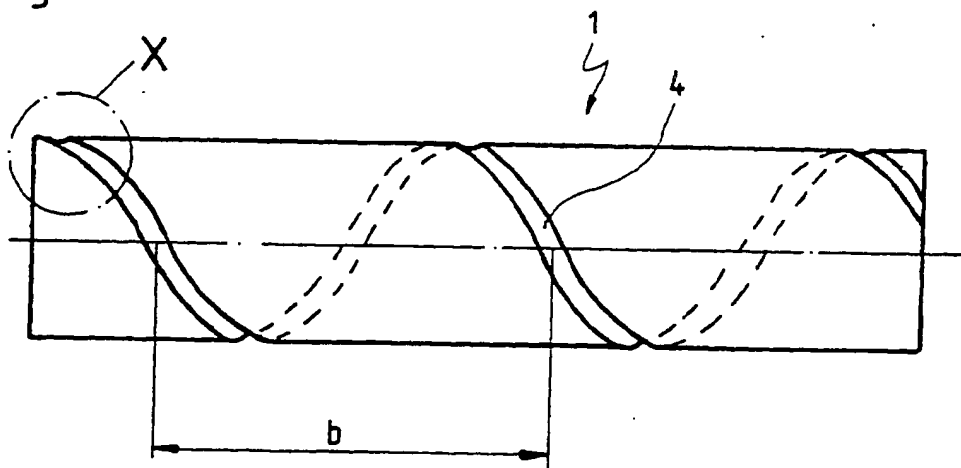
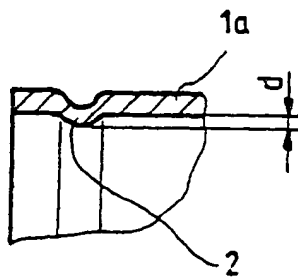


Fig. 3



2213792

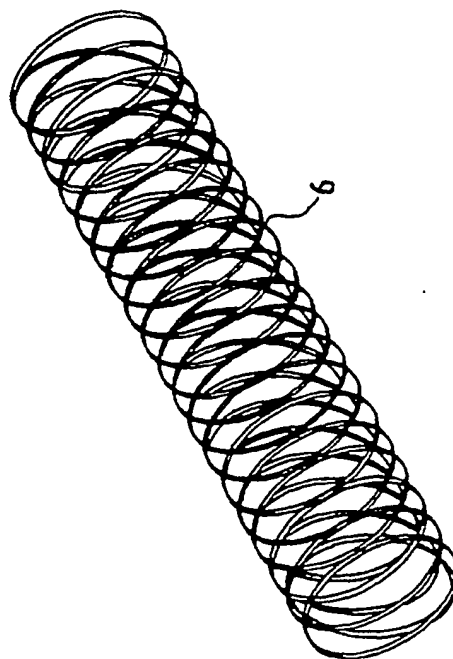
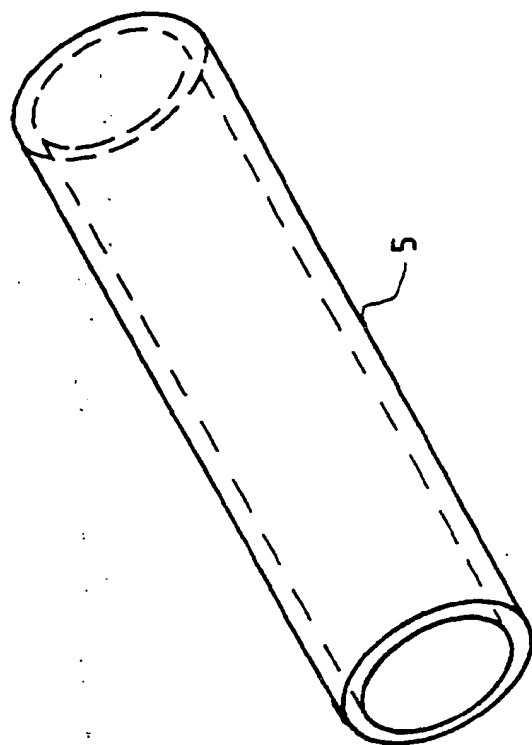


Fig. 4

2213792

CONVEYOR PIPE FOR PNEUMATICALLY TRANSPORTING BULK MATERIAL

This invention relates to a conveyor pipe for pneumatically transporting bulk material.

5 Conveyor pipes of this type usually are made of metal, sometimes of plastics material or glass. In order to keep the frictional resistance as low as possible and to prevent or at least delay the formation of wall deposits, conveyor pipes with smooth wall surfaces have been used.

10 It is known that during transport, especially of certain granular material, so-called angel hair occurs to a certain extent i.e. the occurrence of hairlike, threadlike or strand-like formations. The formation of such angel hair is troublesome for further handling of the bulk material
15 because of its tendency to agglomerate to larger accumulations in silos, gravity mixers, circulation mixers, separators or the like and thus to impair the operation of the parts or in the worst case to lead to a stoppage of operation. In addition, also the manufacturing industry
20 demands bulk material free of angel hair which thus has to be separated by suitable devices.

It is the general belief that the formation of angel hair occurs primarily through friction of bulk material particles at the interior wall surface of the conveyor pipe. Therefore, it has been proposed to use smooth conveyor pipes and to maintain a low conveying speed to keep the friction as low as possible in order to minimize the formation of angel hair.

US-PS 4,621,953 describes a conveyor pipe which is provided with inwardly directed projections preferably arranged in curved elbows, especially at the outer portion of the interior wall surface of the elbow. These projections are not provided to prevent angel hair but rather serve the purpose of avoiding erosion of the pipe wall by breaking the flow of bulk material. Therefore, the projections are of massive design and preferably of pyramid-like shape with a radial height of the order of 2.5 cm.

German Offenlegungsschrift DE-OS 2,008,989 describes a conveyor pipe with an interior wall provided with indentations of slight depth. These indentations, however, are again not provided to eliminate the formation of angel hair but rather to prevent the formation of wall deposits.

There is thus a need for an improved conveyor pipe for pneumatically transporting bulk material which at least minimises the afore-stated drawbacks.

5 According to the present invention there is provided a conveyor pipe for pneumatically transporting bulk material, having a wall provided with projections inwardly directed toward the pipe interior, with said projections having a height, radially of the pipe, which is less than about 1 mm.

10 Suitably, the height of the projections should be at least 10 μ radially of the pipe.

15 While in pipe walls with massive or high projections as provided in a conveyor pipe according to US-PS 3,117,821, the formation of angle hair is even increased, it has been found that the provision of projections of small height produces the desired effect although the contour of the interior wall surface of the conveyor pipe increases the
20 friction. The present invention thus deviates from common belief according to which the formation of angel hair can be held in check by attaining low friction between bulk material particles and the interior surface of the wall.

25 The provision of projections in accordance with the present invention eliminates or at least considerably

reduces the formation of angel hair. It is believed that this effect is achieved because the projections, although overall increasing the friction, keep the period within which the single bulk material particle or bulk material grain contact the pipe wall relatively short so that the superficial heating of the bulk material particles through friction is kept low.

Advantageously, the projections are provided through radial indentations or annular radial constrictions of the pipe wall of the conveyor pipe. The projections may, however, also be attained by a helical radial indentation of the pipe wall.

15

Conveniently the projections may be provided by an insert which is contained within a smooth conveyor pipe and bears closely against the interior wall surface of the conveyor pipe. The insert may preferably be made in the form of a metal grid, metal netting, spiral of the like.

20

For a better understanding of the present invention, and to show how the same may be carried in to effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

25

FIG. 1 is a schematic longitudinal view of a conveyor pipe in accordance with a first embodiment of the present invention,

5 FIG. 2 is a schematic longitudinal view of a conveyor pipe in accordance with a second embodiment of the present invention,

FIG. 3 is a partial cross sectional view of a detail X as designated in FIGS. 1 and 2, and
10

FIG. 4 is a schematic longitudinal perspective exploded view of a conveyor pipe in accordance with a third embodiment of the present invention.

15

Referring now to the drawings, and in particular to FIG. 1, there is shown a schematic longitudinal view of a conveyor pipe in accordance with a first embodiment of the present invention and generally designated by reference numeral 1. The conveyor pipe 1 is preferably made of metal and includes a plurality of radially inwardly directed projections 2 spaced apart in the axial direction of the conveyor pipe 1. As shown in FIG. 3, the projections 2 are defined by annular constrictions or circumferential diametrical
20
25

reductions 3 in a wall 1a of the conveyor pipe 1 and are spaced from each other at a distance a. The conveyor pipe 1 may be provided with such constrictions 3 at any suitable time i.e. after installation of the conveyor pipe 1, by means of suitable tools or also during production through e.g. an extrusion process. Although FIG. 1 shows the constrictions 3 spaced at a uniform distance, it will be appreciated that the constrictions 3 may be provided also at irregular distances.

10

Turning now to FIG. 2, there is shown a schematic longitudinal view of a conveyor pipe in accordance with a second embodiment of the present invention; the only difference to the first embodiment residing in the fact that the projections 2 are defined by a helical indentation 4 in the wall 1a, with the projections 2 being spaced from each other at a distance b with reference to a generatrix.

20

Although both embodiments as illustrated in FIGS. 1 and 2 show conveyor pipes 1 with continuous projections 2 which are directed radially inwardly toward the interior of the conveyor pipe 1, it will be appreciated that these projections 2 may certainly be provided intermittently in the form of single depressions in the wall 1a.

25

The height d of the projections 2 should be smaller than about 1 mm and at least 10μ . The axial distance a in FIG. 1 and the axial distance b in FIG. 2 can be selected as small as possible. However, it should not be greater than twice the diameter of the conveyor pipe in order to ensure the desired effect.

Turning now to FIG. 4, there is shown a schematic longitudinal perspective exploded view of a conveyor pipe in accordance with a third embodiment of the present invention in which a smooth conveyor pipe 5 accommodates an insert in form of a tubular member 6 which bears closely against the interior wall surface of the conveyor pipe 5. The tubular member 6 may be a netting, grid, meshed fabric or the like of metal or plastics material.

CLAIMS

1. A conveyor pipe for pneumatically transporting bulk material, having a wall provided with projections inwardly directed toward the pipe interior, with said projections having a height, radially of the pipe, which is less than about 1 mm.
- 5 2. A conveyor pipe according to Claim 1, wherein the projections have a height of at least 10 μ radially of the pipe.
3. A conveyor pipe according to Claim 1 or Claim 2, wherein
10 the projections lie roughly on the same generatrix having an axial distance from each other which is not more than twice the diameter of the pipe wall.
4. A conveyor pipe according to any one of Claims 1 to 3,
15 wherein the projections are radial indentations in the pipe wall.
5. A conveyor pipe according to any one of Claims 1 to 3, wherein the projections are annular, radial constrictions of the pipe wall.
- 20 6. A conveyor pipe according to any one of Claims 1 to 3, wherein the projections are provided by a helical, radial constrictions of the pipe wall.
- 25 7. A conveyor pipe according to any one of Claims 1 to 3,

including an insert bearing against the interior surface of the pipe wall for providing the projections.

8. A conveyor pipe according to Claim 7, wherein the insert is
5 a metal grid.
9. A conveyor pipe according to Claim 7, wherein the insert is
 a metal netting.
- 10 10. A conveyor pipe according to Claim 7, wherein the insert is
 a spiral.
11. A conveyor pipe for pneumatically transporting bulk
 material, substantially as hereinbefore described and as illustrated
15 in Figures 1 and 3, Figures 2 and 3, or Figure 4 of the
 accompanying drawings.

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.